CLEANROOMS

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Cleanroom Wipers: State-of-the-Art Evaluation Techniques

Steven J. Paley, *Executive Vice President, The Texwipe Company*

What makes the difference in wiper products is the amount of surface contamination they leave behind after use. Particles and fibers, non-volatile residue, metals and metal ions, anions and ESD propensity must be properly evaluated and quantified using techniques such as Soxhlet extraction, scanning electron microscopy (SEM), capillary ion electrophoresis (CIE), surface resistivity testing, charge decay testing and energy-dispersive x-ray (EDX) analysis.

A wide choice of consumable products is offered for sale to the cleanroom marketplace. Distinguishing among these products—wipers, swabs, stationery, face masks, gloves, etc.— to determine their suitability for cleanroom use is difficult without in-depth testing and measurement of critical characteristics. Testing is often an area of controversy as scientific principles are balanced against intuition and ease of testing. In this article, I will attempt to provide a framework for evaluating consumable products, indicate which tests are most important, and detail the current state-of-the-art in the testing of cleanroom wipers.

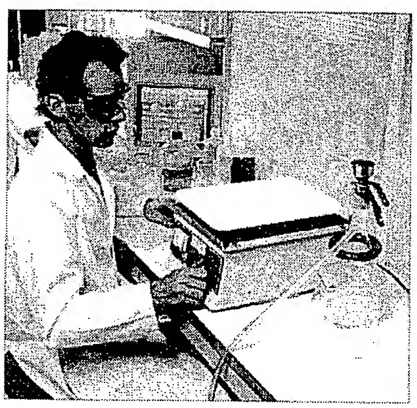
Why test? Is there really a difference?

As device geometries continue to get smaller, the ability to control contamination becomes an enabling technology for the production of integrated circuits and data storage devices. Everything that enters the cleanroom must be considered suspect, in that it can contribute to contamination and affect both yield and reliability. It is therefore incumbent on both the process engineer and the contamination control engineer to have a thorough understanding of all items that are brought into the cleanroom. Consumable articles such as wipers require particular scrutiny because of their ubiquity in the cleanroom and because they are used in almost all fabrication processes.

As it turns out, there are significant differences among the various wiping products, and these differences can be clearly shown through proper testing. The examination of wiping materials can be broken down into two categories: performance characteristics and contamination characteristics. The performance of a wiper involves qualities such as absorbency, wettability, heat resistance, and chemical resistance. These properties are easily tested for by well-accepted standard test methods[1]. A wiper is generally purchased to perform a specific task, such as cleaning a surface, absorbing a spill, or applying a chemical to a surface. Performance measurements are an indicator of how well suited the product is for that task. If performance were the only story, however, wiping products acceptable for most applications could be purchased in supermarkets at far lower prices than those specifically designed for cleanroom use.

SEM equipment used for particle enumeration and analysis.

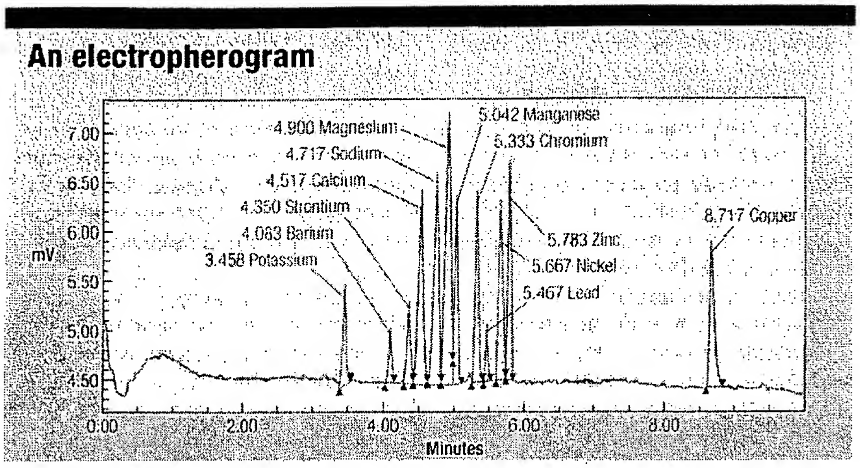
While most wipers are good at absorbing liquid or wiping wetted surfaces, the major difference among products is the amount of contamination they can leave in their wake when used. Wipers laden with microcontaminants will inevitably leave a trail of contamination on the cleaned surface. While tests for performance characteristics are relatively simple and well accepted, testing for microcontaminants released from wiping materials is far more complex. As critical levels of microcontamination become smaller, new test methods and techniques for measurement must continually be developed to accurately and realistically measure the contamination shed from wipers.



Laboratory orbital shaker used in sample preparation for particle testing.

Methods for testing wipers

The major contaminants released from wipers that can affect yield and reliability of semiconductor or data storage devices are physical debris, such as particles and fibers; nonvolatile residue extracted from the wiper when used with solvents; metals and metal ions; anions, which can act not only as conductors but also as corrosives; and the propensity of the wiper material to create and hold an electrostatic charge. Each of these factors needs to be evaluated and quantified for a true assessment of the contamination risk caused by bringing such products into the cleanroom.



An example of an electropherogram. The area under the peaks indicates the ion concentrations for each cation and anion.

Physical debris

First in order of significance is physical debris, or particles and fibers. The measurement of particles and fibers quantifies the physical contamination from the wiper's surface left behind after the wiper has been used. Particles are a microcosm of the surface chemistry of the wiper. They can be made of both organic and inorganic species and are therefore highly detrimental to many processes. In addition, microbial contamination or viable particles residing on wipers can be very deleterious because of their ability to multiply rapidly. Microbes such as bacteria not only have mass but also contain an array of life-sustaining chemicals that can be very damaging to semiconductor and other critical processes. Larger fibers shed from the wiper are easier to detect and eliminate, but because of their size, can cause damage over a much wider area.

The test for particles and fibers is somewhat complex but yields a great deal of information. The test method can be divided into two parts: sample preparation and metrology. The goal of sample preparation is to remove all particles and fibers which could be released from a wiper during normal to vigorous use. To accomplish this, the wiper must be placed under conditions where these particles and fibers will be released and easily captured. Water is an excellent medium for capturing particles; however, to more closely simulate conditions of use, the wiper is immersed in a clean tray containing water mixed with surfactant or isopropyl alcohol. This creates the low surface tension environment the wiper is typically exposed to during use, and allows the particles removed from the wiper to become suspended in the liquid. To maximize removal efficiency of the liquid, the tray is agitated for five minutes using a laboratory orbital shaker. The combination of immersing the wiper in a low surface tension liquid environment and then agitating the liquid allows for a significant release of particles and fibers from the wiper. The wiper is then removed from the tray and the liquid filtered through a microporous membrane filter. The filter will then be examined and the number of particles counted. Needless to say, a complete system blank must be performed before each test.

Scanning electron microscopy (SEM) is the metrology tool of choice for counting and analyzing particles, fibers and other matter released from wipers. Examination by SEM of the membrane filter prepared as described above yields a wealth of information. First, as opposed to other techniques for counting particles, SEM allows direct observation of the particles themselves. Since particles and fibers are clearly visible on the filter surface, they can easily be counted and analyzed. This technique is far more accurate than the use of laser-based liquid particle counters, which are designed to measure perfectly spherical particles under an idealized

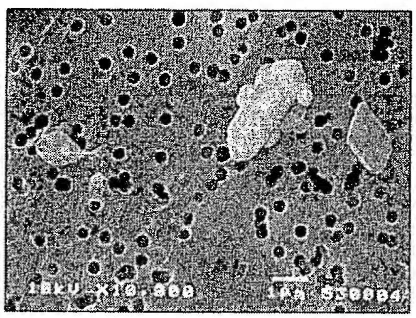
set of conditions. The SEM technique was developed because liquid particle counters lack the sensitivity and range to accurately measure particles and fibers released from wiping materials.[2]

In addition to counting, the metal content of particles can be determined under SEM using energy dispersive x-ray (EDX) analysis. This is an invaluable counterpart to ion measurement techniques which employ liquid extraction. Particles can also be identified through examination of their morphology. An additional benefit is that the SEM will detect both organic films and microbial contamination. Almost any matter removed from the wiper and collected on the filter will be detected and visually displayed on the SEM — the only exception being extremely volatile compounds that would evaporate under high vacuum. However, today's SEMs operate in a low-vacuum mode, which enables the detection and measurement of even these compounds.

In summary, SEM is a very powerful technique for detecting, enumerating and analyzing particles, fibers, and other matter captured during sample preparation. With SEM, we can paint a composite picture of the amount and type of contamination that will be released from a wiper during use.

Nonvolatile residue (NVR)

Nonvolatile residue can be extracted from a wiper when it is used with a solvent. This residue will remain on a wiped surface, leaving it coated with an organic film. Many wipers contain high levels of chemical additives to achieve specific performance characteristics. These additives, which are soluble in common solvents, are often deposited on clean surfaces that have been wiped down with the wiper. Fortunately, numerous techniques exist for detecting the presence of potential extractables.



Microporous membrane filter with collected particles viewed at 10,000x magnification using scanning electron microscopy.

There are several tests available for measuring and analyzing nonvolatile residue released from wipers in a given solvent. The simplest involves boiling the wiper in the solvent for five minutes, then evaporating the solvent and weighing the residue. Weighing must take place on a very sensitive analytical balance, as residue is often in the order of tenths of a milligram. A more extensive technique involves Soxhlet extraction, where the wiper is slowly extracted using condensed solvent vapor over a period of many hours. The residue can then be collected and weighed. With both techniques, residue can be analyzed and identified by means of infrared spectrophotometry. A final technique for establishing the presence of minute amounts of NVR is scanning electron microscopy (SEM). Once the wiper is extracted, the extract solution is filtered through a microporous membrane filter. Upon coming in contact with the filter surface, much of the nonvolatile residue precipitates and forms a film. The filter can then be viewed and analyzed under the SEM.

Metals and ions

Metals and ions can cause significant harm to processes in many ways. Metals in the form of particles can become inadvertent dopants or form conductive bridges across circuit lines. In addition, as with any particle, metal particles can interfere with photolithography processes, making their detection and analysis doubly important. Anions are not only conductive, but can cause corrosion in metalized layers. This is particularly detrimental because it is a reliability issue, and the device can fail long after final test. Both cations and anions can be released through particles or in moisture exposed to the wiper surface. Extraction of the wiper in liquid and subsequent measurement with analytical instrumentation will quantify the burden of ions on the wiper surface.

As mentioned previously, metals released from wipers in the form of particles can be detected and measured using SEM with energy-dispersive x-ray (EDX) analysis. But what about soluble ions on the surface of a wiper? Again, the technique for the measurement of soluble cations and anions has to be broken down into sample preparation and metrology. The sample preparation in this case is fairly straightforward. Ions are released from the wiper into water by immersing a known mass of wiper material into warm deionized water for 15 minutes. Once the wiper is extracted and the ions removed into solution, the concentration of each ion needs to be determined.

The sensitivity criterion for any technique used today should be in the low parts-per-billion (ppb) range, as this level of ionic concentration can be detrimental to many of today's semiconductor fabrication processes. Detection limits in the parts-per-million (ppm) range are no longer sufficient. Several techniques have the required detection limits. One stands out, however, as extremely versatile, capable of analyzing both cations and anions, and also providing detection limits down to parts per trillion (ppt).

This technique is capillary ion electrophoresis (CIE). CIE provides extreme sensitivity with low limits of detection, as well as the versatility to analyze an entire group of cations or anions in each analysis. CIE works by inducing ions to migrate through a narrow capillary under a strong electric field. The migration time of each ion is detected by indirect UV absorption, and the ionic concentration is displayed by peak area in a spectrogram called an *electropherogram*. Capillary ion electrophoresis is used in many laboratories and critical manufacturing environments today for ion analysis and is currently being proposed as an ASTM standard for ion testing.

Electrostatic discharge

Finally, the potential for wipers to generate an electrostatic charge is becoming a greater cause for concern. This is particularly true in the data storage industry, but it is also an important consideration for the semiconductor industry. A simple way to avoid this problem is to use wipers in the wetted state. The problem still exists for dry wiping, and therefore, measurements of electrostatic discharge potential for wipers have been developed.

With ESD becoming a more important contaminant, any material that has the potential to hold a static charge needs to be evaluated for that propensity. Evaluation tools are relatively simple and commercially available. The tests include surface resistivity, which measures the ability of an object to conduct electrical charge along its surface, and charge decay, which measures the time it takes for a known electrostatic charge applied to an object to diminish by 90 percent. Both tests should be conducted under conditions of controlled humidity and temperature. Through these measurements, materials can be characterized as insulative, conductive, or static dissipative. The ideal for ESD protection is for materials to be kept in a static dissipative range, where they will bleed off an electrostatic charge at a moderate and controlled rate.

Summary

This summarizes the current state of the art in testing of cleanroom wipers. As device geometries continue to shrink and contamination control becomes more critical, we can look forward to the challenge of developing more sensitive techniques to measure the potential contamination released from wipers and other consumable products. The test methods described here have been developed and tested on thousands of wipers over the past several years. More sensitive and relevant test methods are in constant development as the nature and quantity of contamination that can cripple a process becomes more elusive. Test method development is an ongoing enterprise and must strive to keep up with the ever more critical demands for contamination control in high technology industries.

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2. H. Bhatacharjee, S. Paley, T. Pavlik, O. Atterbury, "The Use of Scanning Electron Microscopy to Quantify the Burden of Particles Released from Cleanroom Wiping Materials," Scanning, 15, 301–308 (1993).

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The dos and donts of cleanroom swabs and wipes

The do`s and don`ts of cleanroom swabs and wipes

By John Haystead

Swabs and wipes are essential for cleaning surfaces in a cleanroom. This is what they do, and it is their ability to do it effectively that gets them into the environment in the first place. Yet, for critical swab and wipe applications, the most important criteria is often not so much what they do, but what they don`t do.

In the semiconductor and disk drive industries, what they shouldn`t do is leave particulate, fibers or non-volatile residue. They also shouldn`t conduct electricity. In the pharmaceutical and medical device industries, they shouldn`t introduce living organisms or pyrogens. And for all users, what they shouldn`t do, is cost a lot.

To meet these increasingly demanding, often conflicting, requirements, cleanroom swab and wipe manufacturers are continually identifying and evaluating new swab and wipe fabrics and materials, as well as working to improve the efficiency, quality and cleanliness of their production processes. The questions from customers, however, remain the same: "Who`s doing the best, and is the best good enough?"

Tipping the scale

As observed by Dr. Mo Tazi, director of research and development for Coventry Clean Room Products (Kennesaw, GA), "ever-increasing miniaturization requirements throughout the electronics industry are at the same time leading to new requirements for cleaning." And, Jack McBride, president of Contec Inc. (Spartanburg, SC), points out that, "while the products themselves will not change drastically, the scale against which they are measured will."

It is this scale that remains elusive for both manufacturers and users. As pointed out by Andrew Marsh, vice president of sales and marketing for Berkshire Corp. (Great Barrington, MA), "cleanroom science is still very much a black art, and many product claims are difficult to substantiate when not everyone is on the same page when it comes to standards."

While most manufacturers conduct extensive in-house and third-party testing of their products -- and will make this data available -- testing procedures are not standardized throughout the industry, nor are there established product performance standards for specific environments or applications. In fact, says Marsh, "When you`re measuring particulate microcontamination at 0.2 microns and ions at part-per-billion levels, there will be inherent variance in the contamination characteristics of individual items from the same vendor. Guaranteeing consistency within upper and lower control limits is increasingly critical."

Likewise, while ISO 9000 programs can be an important indicator, users can`t assume that they constitute a defacto guarantee of high quality product. ISO documentation measures consistency of performance, not necessarily the highest performance. Quality levels can still vary from vendor to vendor, and in the end, suppliers rely largely on the sophistication and consistency of their own manufacturing, quality-control and testing practices -- and their reputations -- to win and maintain business.

What this boils down to is that the job of evaluating the cleanliness and effectiveness of

new swab and wipe products ultimately falls on the user. It also means, however, that a large part of the process can be accomplished by evaluating the manufacturer.

Value-added processing

Because the major swab and wipe suppliers do not themselves manufacture materials, they must rely largely on the development efforts of textile and foam suppliers. Given the relatively small size of the market, however, cleanroom applications do not get the lion`s share of research attention from these companies. Says Berkshire`s Marsh, "To date, there are really no fabrics that have been developed specifically for contamination-control applications."

Instead, wipe manufacturers largely meet critical cleanroom requirements through value-added processing of conventional materials in controlled environments, principally, proprietary laundering processes. As Howard Siegerman, senior marketing manager for The Texwipe Co. (Upper Saddle River, NJ), describes, "Our real valued-added is in the laundering and packaging process. To provide the required level of cleanliness, you not only have to remove particulates but also emulsifiers, oils, ions and other possible contaminants."

Water purity is a critical element of the laundering process, and several manufacturers place great emphasis on ensuring the cleanliness of their process water. Berkshire, for instance, uses highly-filtered water for its initial laundering processes, followed by 18-megohm semiconductor-grade DI water.

Similarly, Contec has transitioned from the use of contract laundry services to its own vertically integrated laundering and processing facility. Says McBride, "In particular, we invested heavily in our laundry`s water system to ensure low ion and extractable levels." Contec uses Reverse Osmosis filtered water for its initial cycles and 18-megohm DI water for rinses. "High purity water not only controls the introduction of contamination and provides greater product consistency from lot to lot, but also generates greater synergistic effects and reactivity with surfactants," says McBride.

Although most swab manufacturers wash their fabric material before assembling the products, Coventry`s Director of New Product Development, David Lance, points out that swabs may still have residue or particles generated by the manufacturing process. To address this, some companies post-process their swabs using different cleaning solutions. For example, Coventry uses an "Aqua-Prime" aqueous cleaning process on its polyester head swabs to reduce particulates and ion contamination and a "C-Prime" chemical process to lower NVR on its foam-head materials.

Texwipe`s Director of Marketing, Rob Linke, says automation is another critical factor in swab manufacture, providing both better cleanliness and economy. "Swab sizes are getting smaller each year, and this is difficult to accommodate if you don`t have a highly-automated production line in a controlled environment."

Testing and documentation

Product testing is a major value-added service that should be provided by all cleanroom swab and wipe manufacturers, providing users with an important tool for product evaluation and comparison. Leading manufacturers either conduct in-house testing or use third-party testing services. As pointed out by Deborah Leonard, vice president of sales and marketing for Micronova Manufacturing Inc. (Torrance, CA), in addition to testing cleanliness levels, "a wide range of performance characteristics is tested, such as tensile strength, absorbency, temperature range, and chemical compatibility."

Unfortunately, however, there are currently inadequate industry standards for swab and wipe testing procedures and no standards for acceptance criteria.

Contec`s Director of R&D, Dave Nobile, is also Chairman of the Institute of Environmental Sciences working group currently developing standard test methods for cleanroom swabs. According to Nobile, the new standard is expected to be published later this year, and will include particulation and residue testing. While the test standards will certainly provide valuable guidance for users and suppliers alike, Nobile acknowledges that product cleanliness criteria (acceptable levels of particulate or residue) will still not be available, leaving product evaluation largely to the user`s own functional evaluation process.

Materials/applications

Regardless of the value-added processing added by the supplier, understanding the basic characteristics of raw materials is critical to selecting the right product for the job. Parameters include particulates, absorbency, solvent tolerance, abrasion resistance, ESD, ion content, non-volatile residue and economy. Though not written in stone, and variable with new technologies and processes, these are generally accepted guidelines for material/application suitability.

Where high-capacity (absorbency) wipers are required, and where microcontamination control is not as stringent, latex and polyurethane foams are often used. While not recommended for micro-critical environments, these materials are useful for applying cleaning solutions to large surface areas and are used extensively in the pharmaceutical industry.

Other materials can also be used at these non-critical levels. Lym-Tech Scientific (Chicopee, MA), for example, has a polycellulose wipe (60 percent polyester, 40 percent cellulose) targeted for cleanroom construction applications. Contec`s TaxFre wipe is a non-woven wiper treated with an acrylic-based adhesive that works like a tack cloth without transferring adhesive to surfaces. Says McBride, "While certainly not appropriate for critical areas, it can help lower overall solvent utilization and gross contaminant levels outside the fab."

Semiconductor

In semiconductor applications, requirements can be generally divided into three broad categories. Controlled areas (Class 1,000 to 10,000 and above), Subcritical (Class 100 to Class 1,000), and Critical (Class 100 to Class 1 and below). The semiconductor industry is also particularly concerned about ion content. Metal ions such as sodium and potassium are killers for semiconductor wafers, and chloride ions can be a corrosion problem for metal gas and chemical delivery lines. According to Texwipe`s Siegerman, "The stringency of cleaning protocols varies significantly between semiconductor facilities, but in general, cleanliness requirements ramp up quickly as you move into the operational areas." Most experts agree that cellulose (cotton/wood/hemp) is to be avoided at all critical levels of semiconductor manufacture. Although cotton has good heat-resistance properties compared to polyester or blended fabrics, and is also good for mild-abrasive applications, there is a high penalty to pay in particle and fiber contamination levels. Nylon, on the other hand, remains in fairly wide use because of its low particle and fiber characteristics. Nylon, however, suffers from higher non-volatile residue (NVR) values compared to polyester. Many foams and non-woven fabrics are suitable for use in controlled areas. As opposed to woven fabrics whose fibers have a regular geometric pattern, non-woven, "spun-lace" fabrics are made through a hydro-entangling process using fine jets of water to tangle the fibers together in a random orientation. Although there is no additional laundering done on these products, the hydro-entangling process provides a level of cleaning action. According to Siegerman, "hydro-entangled wipes will never be as clean as a laundered polyester product, and woven fabrics usually provide greater tear strength, but they are less costly than woven wipes and some fabrics are surprisingly strong, even when wet." DuPont Nonwoven`s (Wilmington, DE) "Sontara CritiClean

Reusable wipes

Reusable wipe products are appealing to companies trying to minimize their waste and disposal costs. Like garments, users can either launder the wipes themselves or send them out to a cleanroom laundry service. Coventry offers a reusable polyester/nylon wipe called the "Chamois," which, according to Tazi, is suitable for Class 1 cleanrooms. Another reusable wipe material is polyvinyl alcohol (PVA). According to Micronova`s Leonard, users are moving away from the use of Isopropyl Alcohol (IPA) cleaning products in Class 1 and Class 10 environments, opening the way for reusable wipes made of non-woven PVA. Leonard points out that since IPA is used as an evaporating agent, "if you remove it from the equation, you need something else to guarantee a dry surface, i.e. high absorbency." Since PVA is substantially more absorbent than polyester, Leonard says its higher cost can be balanced against the number of wipes required to do the job. Still, Leonard acknowledges that where large amounts of alcohol (30 percent) or acetone are being used, PVA would not work well. According to Leonard, the company`s PVA-based "Nova" sponges and wipes are suitable for Class 10 environments.Berkshire`s Marsh says the use of IPA remains a question of what is the best solvent to get the job done. "While IPA isn`t necessarily the best solvent to remove some materials, the industry will continue to use it until something better comes along."

Presaturated wipers

Presaturated wipers are becoming increasingly popular in the electronics industry because of convenience, safety and environmental issues. Material considerations are also important for pre-saturated swabs and wipes. According to DuPont`s de Jong, "There are significant differences in requirements between pre-saturated wipe materials and dry wipe materials. For example, with wet wipes, since you don`t have to worry as much about the rate of absorption, polyester materials are useful, while dry wipes are more oriented toward absorbency and so tend toward cellulose and rayon-type products. In addition, optimum materials vary according to the kind of solution being used. Aqueous solutions, for example, will differ from other solvents in terms of substrate absorbency. Also, since the longer the material sits in a chemical solvent, the greater will be the risk of extraction, it`s also important to use materials that will not leach over time."

Disk drives

The disk drive industry is currently the largest industrial user of cleanroom swabs, with most cleanrooms operating at Class 100 with some areas to Class 10. Swabs are typically used at the head-gimbal-assembly (HGA) level, and since industry practice is to use one swab per cleaning pass, a very high volume of swabs is needed. Texwipe`s Linke sees the disk drive industry rapidly catching up to semiconductor levels in terms of contamination-control requirements and sophistication. While Contec`s Nobile agrees, he also observes that cotton swabs are still being used to a large extent. Tim Templet, sales manager for Hardwood Products Commercial Products Division (Gilford, ME) explains. "Somewhere in their process, the use of cotton is justified, such as picking up a fiber from a disk drive. Where a polyester swab might cost them $60 to $80/1,000 vs. 10,000 cotton swabs, users instead buy high-quality, wooden-handled cotton swabs, put them in a double polybag and take them into the cleanroom." Even so, Templet acknowledges that cotton swabs aren`t appropriate for completely-contamination-free applications, "which is why people are moving to polyester in those instances. For disk-drive manufacturers," Templet says, "the important swab characteristics are handle rigidity and low-lint. Today, it`s relatively easy to produce a lint-free cotton swab, but the wooden handle remains an issue." Though wooden handles provide rigidity, they also introduce contamination which must be addressed through non-contaminating coatings that need to also be impervious to solvents such as acetone. Ultimately, says Contec`s Nobile, "The challenge is to come up with materials that can effectively clean surfaces of residues and particles without abrasion." While polyester swabs are being used increasingly for these applications, foam swabs are also an option, although not as clean as polyester in terms of particles, ions or non-volatile residue. Chemical-resistant swabs can be made for use with

ESD

In electronics manufacture, and particularly disk drives, the ESD properties of both swabs and wipes are becoming increasingly important. According to Coventry`s Tazi, "The triboelectric effect is much greater today than it was 5 to 10 years ago, and conventional swabs may no longer be usable in 2 to 3 years for these applications." Tazi observes that most companies are transitioning to magnetoresistance (MR) technology for their swabs using either conductive or static-dissipative handles made from specific polymer materials. Since swabs are generally used wet, the ESD characteristics of the tip material are not as critical as the handle material. While dealing with the ESD issues, however, manufacturers must also be concerned with ensuring that their handle materials are compatible with the solvents commonly used in the cleanroom such as acetone, HFCs and alcohol. Some handle materials will rapidly deteriorate in these liquids. Texwipe`s Linke says they prefer to use static-dissipative vs. conductive handle materials for their ESD-safe swabs. "Over the next six months, drive makers will be pushing to control charges to as low as 5V, and conductive handles can easily transfer that level of charge," says Linke. In fact, to reach its goal, Linke says the industry will have to take a system-level view of the entire manufacturing process ensuring that everything in the workstation area is both grounded and made of static-dissipative materials. Since wipes are generally used wet, until recently, they have not had major issues in terms of static-dissipation. Now, however, increasingly stringent ESD concerns are calling attention to these products as well. According to Texwipe`s Siegerman, static-dissipative wipers are increasingly important to the disk drive industry as well as for back-end semiconductor processing after devices have been fully formed and wired. Texwipe`s "ESD-wipe" uses either a nylon or polyester substrate material and a proprietary treatment process. A

Pharmaceuticals and medical devices

In the pharmaceutical and medical device industries, live microbials (5 to 10 microns) are the principal concern, as opposed to microparticles. Therefore, the use of sterile swab and wipe products either via gamma radiation or autoclaving is usually mandated for aseptic areas. Heavy metals and pyrogens must also be dealt with, and as Contec`s McBride points out, the pharmaceutical and medical device industries are also usually dealing with water-based solvents that don`t absorb well in standard polyester materials. Hardwood Products` Templet says foam swabs are used heavily in the medical diagnostic industry, "which is becoming increasingly sophisticated in terms of its contamination requirements." Hardwood Products makes swabs using a non-particulating polyurethane foam. Of the two types of foam used, reticulated and non-reticulated, reticulated foam is more absorbent since it is blown open after being extruded to create cavities. According to Lym-Tech Vice President Peter Hogan, presaturated wipes are also becoming increasingly popular in both the pharmaceutical and medical-device industries. The company has a new "Lym-Sat" presaturated polypropylene wipe product with 70 percent IPA and 30 percent DI water in a resealable pouch. Contec also offers a number of presaturated wipe disinfectant products including phenols, quaternary ammonium compounds, and alcohol-based wipes. Veltek Associates Inc.`s (Exton, PA) "Alcoh-wipe" is an individually-packaged, pre-saturated, sealed-edge polyester wipe. Art Vellutato, Veltek vice president of sales and marketing, advises that wipers used in aseptic environments should only be used once, and warns that bulk-packaged wipes can cause problems as well. "There`s no such thing as a sterile room, and you can actually grow bacillus spores using isopropyl alcohol," says Vellutato. Vellutato also sees particles of increasing concern to the pharmaceutical industry. "Particle counts can be as important as actual organisms, since they nee

Back to the source

Despite the sophistication of their post-processing, treatment, packaging, and testing techniques, swab and wipe manufacturers frequently find themselves frustrated with the capabilities of the raw materials they have to start with. For example, says Lym-Tech`s Hogan, "Knitted fabrics are expensive and we`re always looking for an economical non-woven product that can be used in a Class 10 cleanroom. Though we`ve tested product from a number of mills, the results are usually disappointing." This situation may be changing somewhat, however. According to Contec`s McBride, "As the cleanroom market has grown, we`ve begun to see more interest from the fabric manufacturers and more emphasis on product development and process control for cleanroom applications." In particular, DuPont Nonwovens is frequently mentioned as a possible source of advanced cleanroom fabrics. According to de Jong, this is because "we already view the cleanrooms market as significant in terms of the application of leading-edge technology, and it will be even more so as it broadens into other critical manufacturing areas."

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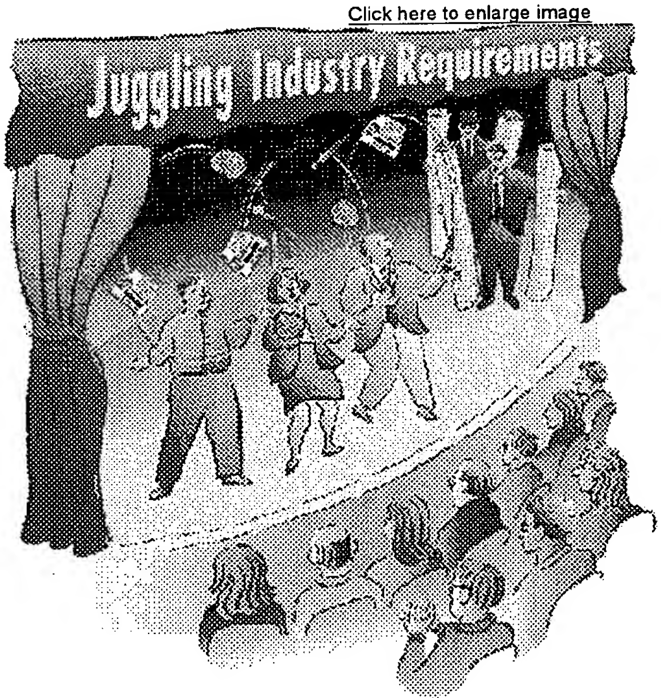

When producing their wares, cleanroom swab and wipe manufacturers must juggle the needs of the disk drive, pharmaceutical, and semiconductor industries.